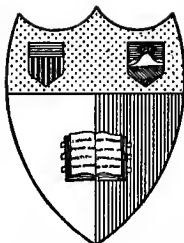


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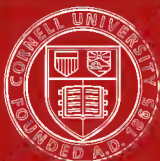


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PRESENT-DAY APPLICATIONS OF PSYCHOLOGY

WITH SPECIAL REFERENCE TO
INDUSTRY, EDUCATION
AND
NERVOUS BREAKDOWN

92

BY

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PRESENT-DAY APPLICATIONS OF PSYCHOLOGY

With special reference to Industry, Education, and Nervous Breakdown¹; two lectures delivered at the Royal Institution of Great Britain on April 11th and 18th, 1918

AT one time all systems of knowledge were embraced under the term Philosophy. From it long ago separated Natural Philosophy, the scientific study of living and lifeless matter, and more recently there has emerged as an independent science Mental Philosophy or (as it is now called) Psychology, the scientific study of the human and animal mind. Each of these two branches of Natural Science—physical and psychical science—has developed methods peculiarly its own. Each has come to be more or less independent of the common parent Philosophy, as each has become more or less exclusively devoted to systematic, concrete observation and experiment. The methods of modern (or, as it is inadequately termed, experimental) psychology have come to differ from those of physiology and from those of physics, because their aims and outlook are different.

The differences in standpoint between the physicist and the psychologist may be conveniently illustrated by such an experiment as that of determining the point of equality between two lengths, colours, or

¹ The industrial applications of psychology are described on pages 7-26; nervous breakdown is discussed on pages 29-47.

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other sensory experiences, or the point of just appreciable difference between them ; one of the two being

**The stand-
points
of the
physicist
and the
psycholo-
gist.** a fixed 'standard' and the other being a 'variable' which has to be made equal to or just different from it. The physicist only uses such an experiment to help him to arrive at the properties of matter ; he employs no special method, but proceeds

at random to make one length equal to another, to produce one colour or brightness just different from another, etc. The psychologist, on the other hand, is concerned with the differences that arise according to whether the observer manipulates the apparatus, himself producing the point of equality or of least perceptible difference, or whether he has the two experiences, the standard and the variable, presented to him by some other person and has merely to pass judgment on them. The psychologist also determines the differences that arise according to the relative spatial and temporal positions of the variable and standard, and according as the point of just appreciable difference is approached from an inappreciable difference or from an easily appreciable difference ; and so on.

A specific example may make clearer the special standpoint of the psychologist. I was recently invited to apply my psychological training to an experiment of some importance being conducted by physicists, which consisted in leading by separate tubes the same sound to the two ears and in manipulating the two tubes so that the two ears received the same sound under precisely the same conditions, in which case the sound was of course localised by the observer exactly midway between the two ears within the head.

APPLICATIONS OF PSYCHOLOGY 5

I found that the apparatus was being used by persons who had not been submitted to any previous test as regards their auditory acuity, nor as regards differences in the auditory acuity of their two ears. Now it was essential in these experiments to be able to localise faint sounds; and a sufficiently great difference in the acuity of the two ears (often unknown to the observer) must, in certain cases at least, throw the sound over to the keener ear when conditions were such that to a person with normal hearing the sound would be localised midway between the two ears. I also found that obvious differences might arise according as the apparatus was manipulated so that a rightward sound or a correspondingly leftward sound was adjusted to become a midway sound. Three obvious psychological factors might be here involved. The first of these was 'inertia of judgment,' the observer continuing to give the same reply owing to the nature of his previous answers. The second was 'adaptation,' the observer becoming adapted, and so coming to be less sensitive, to the right or left character of the sound, and its lateral character hence becoming less noticeable. The third factor was 'expectation,' the observer stopping before he had reached the true middle position because he had been expecting that position to be reached. Yet another factor was found to consist in the tendency of certain individuals with normal hearing to localise doubtful sounds preponderatingly on one particular side.

For the physicist such problems have no interest; nor have they for the physiologist. Neither physicist nor physiologist is concerned with the choice of method and with the underlying psychological factors. Let us suppose that the physiologically trained

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physician wishes to determine the keenness of vision in a subject. He confronts him with the well-known cards of test-types. He is not particular in the use of any well-defined method of procedure. Individual differences of familiarity with letters, due to illiteracy, are not taken into account. Differences in the ease of recognition of different letters are not considered. The physiologist proceeds in his investigation of sensory experiences just as if he were dealing with the measurement of *pure* sensation. He takes no account of the psychological complications just mentioned, nor of others such as the influence of excitement, fatigue, and individual differences in the use of interpretation. The psychologist, on the other hand, carefully predetermines his method, choosing one of the established methods which can be precisely repeated on the same subject or on other subjects for comparison of individual differences or of the psychological factors of practice, fatigue, and the like. He chooses an apparatus which shall eliminate, so far as possible, differences due to education, interpretation, etc.

That psychological factors really do enter into what are commonly regarded as physiological or medical tests, that consequently even such a 'low-level' test as the examination of sensory acuity needs to be conducted by an examiner trained in psychology, is indicated by a recent claim that on Monday mornings not only is there a notorious deterioration in the efficiency of work performed, but there may also occur a diminution in visual and auditory acuity among the workers. Clearly psychological factors, some of which we shall presently come to recognise in our analysis of

APPLICATIONS OF PSYCHOLOGY 7

the work curves, must be responsible for so widespread a change. I may add that most of the workers here tested were abstainers from alcohol.

So far I have alluded to psychological work in sensory experience. But in other parts of the psychological field, the results of applied psychology are proving even more valuable. The

science of education is interested in the psychological investigation of the relation between such general factors as originality, the power of sustained attention, etc., and different specific abilities. Education is also interested in the psychological experiments that have been devised to examine whether the practice or fatigue resulting from a given piece of work is followed by improvement or by deterioration in similar or dissimilar pieces of work. To what extent can 'formal training,' as it is called, say in memorising Latin verses or dates, be shown to yield improvement in other feats of memory? To what extent is training acquired by one side of the body reflected on the other side? To what extent does fatigue in one school subject involve a general fatigue for other subjects?

But I wish to pass on to consider the applications of psychology to the conditions of industrial efficiency and to the study of individual mental differences. Industrial efficiency and individual mental differences.

For many years past psychologists have been analysing in the laboratory the factors influencing muscular and mental work. For willed muscular work they have relied mainly on the ergograph, an apparatus which studies the power of work of a single finger periodically bending and extending at a single

8 APPLICATIONS OF PSYCHOLOGY

joint, each bending of the finger raising a given weight a certain distance. The total distance through

The ergo-graph and muscular work curve. which the weight has been moved can afterwards be calculated, and since the weight is known, the total work can be determined. The movements of the finger

can be recorded by a lever brought to bear on a travelling smoked surface, and thus an ergogram or 'muscular work curve' is obtained.

A 'mental work curve' is obtained by calculating, say minute by minute, the amount of work correctly

The mental work curve. performed in some simple process, such as erasing a prescribed letter (comparable to proof-correcting), or adding or multiplying pairs of figures, or placing a dot in the centre of each of a number of small circles presented rapidly one by one to the observer.

With the ergograph, complete exhaustion is sooner or later attained, the speed of its onset depending on

Recovery from ergo-graphic fatigue. the condition of the worker, on the weight lifted, and on the rate of repetition of the movement. After sufficient rest, complete recovery occurs, so that a second ergogram

equal to the first is obtainable. The amount of rest necessary for complete recovery is found to vary with the amount of work done, a decrease in the amount of work allowing of a more than corresponding decrease in the period of rest needed for recovery. Thus if the finger, lifting a given weight, make 30 contractions in 60 seconds, a 2 hours' rest is necessary to obtain an equally good repetition of this work. If, however, with the same weight, the finger make 15 contractions at the same rate, *i.e.* in 30 seconds, not 1 hour's rest, but half-an-hour's rest

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suffices for recovery. If, to take a *reductio* almost *ad absurdum*, the finger make only one contraction, only 10" rest need be given between that and each succeeding contraction in order that the contractions shall continue, in theory, indefinitely. That is to say, ideally, in an eight-hour day, 120 contractions can be obtained if the subject works for spells of a minute, 240 contractions will be obtained if he works in spells of half-a-minute, and 2400 contractions will be obtained if he works in spells of 2", resting until recovery after each spell.¹ These data, of course, are complicated in actual application by various other factors, some of which we shall immediately study, but the importance of regulating the length of work periods for the efficiency of muscular and mental work is, as we shall see, becoming generally recognised.

Next, in importance; to the length of work periods, comes the consideration of the weight lifted at each effort. It is clear that with a very light load the ergogram could be continued almost indefinitely, while with a very heavy weight only a few contractions could be carried out before exhaustion resulted. A certain load can be found for each practised subject, which allows of the performance of the maximal amount of work.

Influence
of the load
on effici-
ency.

This principle has been applied practically in the case of 500 shovellers who were being employed in shovelling, with a shovel of constant size, material of very varying weight,—sometimes coal, sometimes ashes, at other times heavy iron ore, etc. Experiments

Industrial
applica-
tion.

¹ Cf. "Lectures on Industrial Psychology," by B. Muncio, Sydney, 1917, where many of the facts here recorded will be found.

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were conducted with shovels of different sizes in order to ascertain the optimal weight per shovel load for a good shoveller. The best average weight was found to be 21 lbs. Accordingly shovels were made of different sizes, in proportion to the heaviness of the material shovelled, so that each shovel whether full of coal, ash or iron, etc., weighed 21 lbs. This was the most important innovation, although others were at the same time carried out. The results were as follows:—(i) the average amount shovelled per day rose by nearly 270 per cent.—from 16 to 59 tons per man, (ii) 150 men could now perform what 500 men had performed under previous conditions, (iii) the average earnings of the shovellers increased by 60 per cent., (iv) the cost to the management, after paying all extra expenses, was reduced by 50 per cent., (v) there was no evidence of increased fatigue of the shovellers.

In the case of mental work curves, a more detailed analysis has been attempted in the laboratory, the principal factors which have been analysed being fatigue, practice, incitement, spurt and settlement; and by varying the conditions attempts have been made to measure some of these constituents of the work curve.

Obviously fatigue and practice work in opposite directions, and the work curve obtained is the resultant of these factors. Generally speaking, the influence of practice is great at first, but smaller later, whereas the influence of fatigue is small at first but greater later. The effects of practice disappear during a pause slowly at first but faster later: as a celebrated

**Analysis
of the
mental
work
curve.**

**Fatigue
and
practice.**

APPLICATIONS OF PSYCHOLOGY 11

pianist once said,—“If I miss *one* day's practice, *I* notice the difference: if I miss *two* days' practice, *my wife* notices the difference: if I miss *three* days' practice, *the public* notices the difference. The effects of fatigue, on the other hand, disappear during a pause, rapidly at first, but more slowly later, as the harmful waste products of activity are removed and the worn tissues become completely refreshed.

We have definite experimental evidence that much of the improvement that occurs with practice proceeds unconsciously, and not only during but also between periods of practice. Hence the value of distributed repetitions¹; and hence the foundation of the old adage that we learn to skate in summer and to swim in winter.

We now recognise that one of the most important effects of practice lies in the synthesis of a number of previously separate acts of attention into a single act. The span of attention becomes widened, but this widening does not occur continuously during practice but in jerks. Hence in learning such a skilled movement as typewriting, the practice curve does not show a regular improvement but it rises up to a certain level, and remains, despite practice, for some time at this level, until a certain stage of mental organization is reached when it starts to rise again until a further plateau is reached, and so on.

Just as the practice of complex acts brings about unconscious organization, so fatigue involves unconscious disorganization, long before actual exhaustion occurs. An even earlier safeguard against the onset of exhaustion consists in the development of nervous impulses inhibiting further activity.

¹ See later, page 17.

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A brief pause causes a change in the mental work curve which cannot be explained merely by loss of practice and fatigue. After the resumption of work a certain period is required for getting under way. The human machine has 'grown cold'; it must needs be 'warmed up.' This factor is evidently something different from practice; it has been termed 'incitement.'

Yet another factor complicating the work curve is the presence of 'spurts.' Work is not performed regularly, apart from the effects of practice, fatigue and incitement. It comes in spurts and irregular waves due to fluctuations of volitional tension dependent on varying interest, emotion, etc. The most striking spurt occurs immediately upon the resumption of work after a rest; a spurt may often also occur when, despite fatigue, the worker is aware that he is reaching the end of his task.

Lastly, the factor I have called 'settlement' must be mentioned. It, in turn, is distinct from practice and from incitement. It is not improvement from previous exercise, it is not the warming up of a machine that has grown cold with rest. It consists in settling down to a mental state secure from distraction.

These various factors, practice, fatigue, incitement, spurt, settlement, must also occur in the work curves obtained from industrial labour. In the curves actually obtained from Florentine typesetters, the influence of fatigue and initial spurt and the effects of rest alone are demonstrated. But this is owing to the length of the

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time-unit (one hour) employed. Moreover, different conditions and kinds of work will yield different curves. Thus when the fatigue involved is slight, and the influence of practice or of end-spurt is sufficiently great, a larger instead of a smaller output of work will occur towards the end of the day's work.

In regard to settlement, we have to bear several psychological facts in mind. First, the human mind is capable of quite remarkable power of neglect of distracting impressions. (Cf. ^{Importance of freedom from distraction.} the ability to hear speech amid the noise of a factory ; or the ability to banish extraneous sounds while doing mental work.)

Secondly, when such distractions (noise, glare, needless movements) are reduced from a maximum to a minimum, the diminution in the strain involved in their neglect leads to noticeable improvement in the output of work ; e.g. a case is on record where the output was increased by 25 per cent. after removing to quieter surroundings certain employees who had been hitherto working in the noise of a yard.

The importance of industrial fatigue is shown in the close correlation which has in some cases been found between the work curve and the curve of the frequency of accidents. ^{Accident curves.} Certain accident curves have indicated that the number of accidents may increase as the output of work becomes less, the number being smallest in the first few hours of the morning and after the dinner hour and being greatest towards the end of the morning or of the afternoon. Of course in some factories there may be a stoppage of work on the part of the machines or of the operatives at the last hour of the day and hence a decline in the accident

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curve. End-spurt might produce the same effect. So might the excitement which may arise from (and mask) states of fatigue, or result from other psychical factors. Moreover, there are other causes of accidents, besides fatigue.

Laboratory experiments have shown that the subjective *feeling* of fatigue is no criterion of an incapacity to perform satisfactory work. We have experimental evidence that an excellent output of work may be obtained when the feeling of fatigue is severe. A similarly untrustworthy (but opposite) feeling of efficiency occurs under the influence of alcohol and in certain conditions of fatigue, when the work performed under its influence is actually less accurate and reliable.

During rest after a period of work a certain amount of practice is lost, but as an offset to this, a certain amount of fatigue is lost, and there is also, on the other hand, a loss of incitement and settlement. Various experiments have been conducted in order to find the 'most favourable pause,' *i.e.* the pause in which the various factors so operate as to produce a maximal amount of work after the pause.

In the factory the importance of interpolating more frequent rest pauses is only just beginning to be realised. There can be no doubt that an unbroken morning or afternoon's work of four or more hours is economically unsound, and that the systematic introduction of rest pauses (together with the elimination of periods of slackness, needless movements, etc.) must lead to a vast improvement in quantity and quality of work.

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Let me exemplify this by quoting the results of a trench-digging competition during the present war between two companies. The officer of one company allowed his men to work uninterruptedly until their condition demanded a rest. The officer of the rival company divided his men into three sections, of which each section successively worked their utmost for 5' and rested for 10'. This systematic arrangement resulted in an easy win for his company. So too in a certain munitions factory, the interpolation of a 15' rest in each hour is reported to have yielded a definite increase in the output of work, despite the initial objection of the men, who were being paid by piece-work.¹

The German shipbuilders have recognised the better output of work on the Clyde, despite, nay rather because of, the shorter hours of their daily work. A certain firm in Manchester had factories both in Lancashire and Belgium. The hours of work in their Lancashire factory were 51 a week: in their Belgian factory 66 a week. Yet for identical work, the Lancashire operatives produced the larger output.²

In this connexion, I should like to quote an instance,³ occurring recently in a surgical-dressing factory where women were engaged as yarn-winders, an occupation requiring much dexterity and the constant repairing of broken threads. The daily hours of work were ten, namely from 6-8, 8.30-12.30, 1.30-5.30, and in addition to these ten hours, overtime

¹ "Interim Report on Industrial Efficiency and Fatigue," Ministry of Munitions, 1917, pages 10, 16.

² Cf. *Engineering*, October 6th, 1916, page 231.

³ Given in "Second Interim Report of an Investigation of Industrial Fatigue," etc., by Prof. A. F. Stanley Kent, 1916, pages 37, 38.

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was worked from 6-8 p.m. Among these yarn winders was an unmarried woman of 32 who claimed that by not working before breakfast (from 6 to 8 a.m.) and by refusing to work overtime (from 6 to 8 p.m.), she turned out more in the remaining eight hours than if she had worked the whole twelve hours. Her claim was put to the test by comparing her monthly output during eight hours per day with that of three first-class hands working during the first fortnight at twelve hours per day and during the second fortnight at ten hours per day. Despite the fact that the short-timer stayed away the whole of one working day and three half-days during the month, her output of 52,429 bobbins easily beat the average output of her three competitors' 48,529 bobbins. In 32 per cent. less hours of work she produced 8 per cent. more work. Further, the output of the three competitors was greater by more than 5 per cent. during the second (as compared with the first) fortnight, when no overtime was being worked and the length of the working day was thus reduced by 16.6 per cent.

Other instances might be cited in which psychological experiments point the way to economy in mental and muscular effort by the employment of the best method. Among the numerous investigations made on the powers of memory, few are more striking than the comparison between what have been called the 'entire' and the 'sectional' methods of learning. By the entire method of learning, say, twelve lines of poetry, is meant the method which proceeds by reading through the entire twelve lines, then endeavouring to reproduce them, next reading the entire twelve lines afresh, again endeavouring to reproduce them,

Economical methods of learning.

APPLICATIONS OF PSYCHOLOGY 17

and so alternately reading and endeavouring to reproduce the whole twelve lines until success is attained. This method has been compared experimentally with the sectional method, in which the twelve lines are divided into six (or three) sections and a section, of two (or four) lines, is learnt by alternate reading and attempted reproduction until it can be reproduced correctly, and then the next section is similarly learnt and added and then the next (and so on), until the whole twelve lines are learnt. It is found that the sectional method is distinctly more wasteful than the entire method. Investigations have also been made on the effects of accumulated, as compared with distributed repetition in learning. In what degree is it more economical, for example, when applying, say, twenty-four repetitions to learning a given task, to employ the repetitions all at once, or to give twelve at two different times, or eight at three different times or four at six different times, and so on?

The importance of a good method is well enough recognised in learning such accomplishments as type-writing, golf, and playing a musical instrument. Yet in regard to industry, the need ^{Motion-}study. for good method and the need for systematic training are only just beginning to be realised, as is instanced in the following illustrations of what is now technically known as 'motion-study.' A systematic study of the conditions of brick-laying by Gilbreth in America resulted in the reduction of the number of separate movements involved from eighteen to five, with the consequence that thirty men were able to lay as many bricks as about a hundred men according to the old method, with the expendi-

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ture of less fatigue and the receipt of much higher wages. The useless movements were eliminated, and the number of acts of decision were reduced by the following changes,—(i) the avoidance of repeatedly stepping towards and away from the pile of bricks and mortar and of stooping to pick up each brick and trowel-full of mortar (an enormous waste of bodily energy), by placing the materials close to the workman's grasp; (ii) the avoidance of turning each brick over in his hand, by having the bricks previously arranged by a less skilled workman so that the best facing of all the bricks lay in the same direction; (iii) the suppression of the taps of the trowel made by the workman on each brick as it is laid and their replacement by slight hand-pressure (in order to obtain the proper thickness of the layer of mortar). Economy was also secured by the substitution of simultaneous symmetrical movements of the two limbs for successive movements; *e.g.*, the workman was instructed to pick up the brick and the trowel in his left and right hands simultaneously, instead of successively.

Similar economy, as regards the assembly (fitting together) of parts, has been introduced into at least one munitions factory by the more liberal use of unskilled labour in placing the parts in convenient positions ready for assembling, by the introduction of regular order and rhythm, by fixing the positions of the tools to be employed, by avoiding needless standing, glare and noise; thus eliminating unnecessary worry and fatigue and reducing the number of the acts of decision on the part of the skilled workmen to a minimum.

Motion-study has been also advanced by the

APPLICATIONS OF PSYCHOLOGY 19

employment of the chronocyclegraph.¹ An electric lamp is attached to the moving limb and its movements are photographed as a white line on a dark background. Into the electric circuit of this lamp an interrupting tuning-fork is introduced so that the movement studied instead of being revealed as a continuous white line is revealed as a series of dashes ; thus indicating the relative speed of the different parts of the movement, according to the closeness of the dashes. A further improvement consists in replacing the dashes by blunt arrowheads, indicating the direction of any part of the movement ; and a squared screen is photographed on the plate before the movement is photographed, thus measuring the extent of each part of the movement. By the aid of stereoscopic photography the movement can be exhibited in relief, *i.e.* in three dimensions, from which a wire model can be prepared for the purposes of study and instruction ; useless, needless and harmful movements being thus brought to light and eliminated. Such a wire model has been found to have several advantages over a cinematographic display of the movement. The movement is constantly there before the eyes of the student, instead of being given to him in a fleeting presentation. The movement may be also regarded from any angle, instead of being confined, as in the cinematograph, to the angle from which the camera viewed the movement.

The importance of applied psychology is nowhere more clearly seen than in the study of individual mental differences, which has long been a subject

¹ See "Motion Study and Time Study Instruments of Precision," by F. B. and L. M. Gilbreth, *Transactions, Internat. Engineering Congress*, 1915.

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of laboratory investigation. The *average* muscular or mental work of adults under given conditions, the *average* memory of children of a certain age, etc., are no doubt of importance both for the psychologist and in the industrial, medical and educational applications of such knowledge. But still more important is the study of the *individual* mental differences which enter into every conceivable psychological test. Tested for sensory acuity, one individual will make every use of vague suggestions and interpret them correctly, another will refuse to act save on the basis of definite, sure, sensory impressions. Tested for memory, one individual will learn better when he sees than when he hears the material to be learnt; as he endeavours to reproduce what he has learnt, one will see it in his mind's eye, as we say: one will hear it in his mind's ear, as we may say: another will reproduce it without any recognisable imagery, merely 'knowing.' These and other more important individual differences demand recognition in childhood for educational purposes, and for help in the choice of a profession or trade when the time for this choice draws near.

But probably the last reason for choice of employment, in the vast majority of cases, is the innate fitness of the boy or girl for some special vocation. In London, the County Council have appointed a psychologist to their educational staff; but so far no attempt has been made in this country to keep at each school a *dossier* in which the special characteristics of each child are entered and to establish a vocational advice office, where, on the basis of such information and

The need
for voca-
tional ad-
vice offices.

APPLICATIONS OF PSYCHOLOGY 21

other observations, expert opinion could be given as regards the kind of work which a boy or girl is best fitted to perform. Nor has any general attempt been made to provide systematic psychological investigation of individual cases of mental retardation and precocity. The waste of educational effort in the schools, the waste of time and money in apprenticing children to trades at which they will never efficiently work, is simply incredible. The child fitted for mental work takes up manual employment. Fitted for outdoor work, he takes up indoor employment. Having directive capacity, he is wastefully used as dependent on others. Having an interest in general principles or in administration, he finds himself engaged in a narrow detailed routine. Being quick and impulsive, he is placed where cautious deliberation is essential. And vice versa. These and numerous other individual differences could have been ascertained at the outset of his vocational career.

The following examples will suffice to show how they *have* been ascertained by the aid of psychological examination.¹

Twenty-seven of the applicants for ten vacancies for the post of salesman to a large company had been selected on the ground of health, appearance and previous record. A psychologist was asked to choose from these twenty-seven the ten mentally best fitted for the work. He studied their mental work curve by means of the letter (a) Sales-erasing test (see page 8), observing men. the care, steadiness, improvability, fatigability, etc.,

Examples
of the in-
vestiga-
tion of in-
dividual
mental dif-
ferences for
industrial
purposes.

¹ Cf. "Psychology and Industrial Efficiency," New York, by Prof. H. Münsterberg.

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shown. He investigated their memory by reading to them numbers of 7-10 digits, newspaper paragraphs and pairs of associated words, and getting them to reproduce the numbers, the substance of the paragraphs, and the other member of each pair of words when the first member was read to them. He determined their span of apprehension by the tachistoscope (an apparatus for the momentary display of a number of objects), their speed of reaction by getting them to sort out as rapidly as possible forty-eight cards into four piles according to the letter printed on them, and so on. In this way he selected the best applicants for the ten vacancies.

The same psychologist was asked to devise a test for examining the drivers of electric trams as regards their speed of apprehending and acting on a given situation. A ten minutes' test applied to each of the employees showed a very close correspondence between their efficiency at this test and their efficiency in actual service, as judged by the number of accidents recorded against them.

In a recent visit to an 'automatic' telephone exchange, I was informed that the special saving was in the time hitherto wasted in the reaction of the telephone exchange girls, so that now fewer trunk lines were needed. Psychological tests on the speed of reaction to light, the speed and accuracy of movement, the span of apprehension, the memory for figures heard, have been applied with good effect to the choice of applicants as telephone operators.

In a bicycle-ball factory, 120 girls were employed in inspecting balls for flaws, the balls lying along the

APPLICATIONS OF PSYCHOLOGY 23

interspace between the backs of two fingers of the left hand, and defective balls being removed by a magnet held in the right hand. For this work good vision, good powers of observation ^(d) Bicycle-ball factory. and quick reaction were essential. The result of a study of the reaction times of these girls was that some of the most intelligent and industrious and honest of them were found unsuited to the work and were transferred to more suitable occupation elsewhere. By employing only the most suitable workers, thirty-five could do the work of the previous hundred and twenty, their hours were reduced from $10\frac{1}{2}$ to $8\frac{1}{2}$ per day, two days' holiday was given per month, their wages were increased by nearly 100 per cent., the accuracy of the work was increased by two-thirds, and there was a large decrease in the cost of production of the balls.¹

In this country we are just beginning to apply the study of reaction times to the selection of candidates for the Royal Air Force.² Their visual, auditory and tactual reaction times are ^(e) The Royal Air Force. determined. A pilot who is slow to react when a sight or a sound or a touch is presented to him which is fraught with danger and demands immediate action, can never make a first-class fighting aviator. But still more important than a speedy reaction is a speedy *appropriate* reaction. This again has been the subject of laboratory psychological investigation where a series of possible reactions, one right, the others wrong, is afforded the observer.

¹ Cf. F. W. Taylor's "Principles of Scientific Management," also quoted by Münsterberg and Muscio (*op. cit.*).

² Cf. *The Lancet*, March 16th, 1918, page 399.

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Thus the applicability of experimental psychology to war problems is beginning to gain recognition in this country. When the United States entered the war, a number of psychological committees were immediately appointed in that country to advise on the examination of recruits, the selection of men for tasks requiring special skill, the examination of candidates for aviation, the problems connected with aviation, the consideration of visual and acoustic problems connected with the war (*e.g.* the principles of camouflage, and of submarine and aeroplane detection), the problems connected with training, discipline, recreation, self-control, etc.

Two procedures contrasted. But instead of increasing efficiency by selecting the most suitable and efficient workers, and by modifying the conditions of their work by adequate rest pauses, by economizing the number of movements and of acts of decision, and the like, it is far simpler, where greater output is needed, simply to pour in more untrained and unfit workers into the factory, more inefficient clerks into offices, and so on. In place of increasing the efficiency and specialisation of our larger factories, hospitals, etc., it is tempting to adopt the easier and, really in the end, more costly method of scattering enormous numbers of relatively inefficient, semi-amateur, small units over the face of the country.

The costliness and inefficiency of this procedure are obvious. Its attractiveness is due to our national habit of muddling through somehow and to the opposition of workers to the introduction of industrial psychology and scientific management. They fear very naturally that increased output and economy of labour can only mean the discharge of a certain

APPLICATIONS OF PSYCHOLOGY 25

number of employees into unemployment, the destruction of interest, the loss of liberty to employees, and still greater profits accruing to capital ; and they confuse industrial psychology and scientific management with the vicious policy of 'sweating' or 'speeding up.'

The future can only lie in educating both employers and employees. The employer must understand that increased profits, arising through increased efficiency and diminished cost of output, ^{The present} are to be properly shared between capital ^{outlook.} and labour ; and he must take special pains that the whole objects of industrial psychology are explained to the workmen and that their co-operation is obtained before any systematic observations and experiments are begun in the factory. The employees must be educated to see that different individuals are innately fitted for different kinds of employment, that it is for their own benefit, not in order to restrict their freedom of choice, that advisory vocational offices will be established, and that more rest does not mean less pay if it produces increased efficiency and does away with unlawful slacking during work hours. They must be made to understand that motion study develops interest in their daily work and that the abolition of needless movements no more involves speeding up than the introduction of shorthand necessarily involves severer 'sweating' than ordinary writing.¹ Both employer and employee must strive to the result that by such shorthand methods of work and by the suitable selection of workers the duration of the day's task will be so limited that at its close the workers are left with sufficient energy to enjoy their

¹ Cf. Muscio, *op. cit.*, pages 43, 44.

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rest and to amuse themselves profitably, not degradingly, during this rest. The time seems ripe for the formation of a society, composed of employers, employees, and scientists all working with this end in view.

So far I have dealt with some of the industrial and educational applications of experimental psychology in the field of *knowing*,—and resultant doing. I pass on now to discuss the application of psychology in regard to the second great division of mental activity, *feeling*,—and resultant doing.

Until recently feeling has been chiefly investigated in the psychological laboratory by studying the physical reactions accompanying pleasure, displeasure and the emotions. Apparatus has been employed to detect changes in the vascular and respiratory system and in the bodily movements accompanying such feelings. The pneumograph has been used to record the alterations in rate and depth of respiration on a travelling smoked surface. Similar records have been made of the frequency and force of the heart beat, and of the narrowing or widening of the blood vessels under conditions of pleasure, displeasure or emotional experience. The steadiness or tremulousness, etc., of the muscles of the body has also been investigated.

Such investigations are being to-day applied in the examination of aviators for their fitness for aerial fighting. Some of the most unsuitable candidates are found to show the most marked increase in the frequency of respiration and heart beat, the most marked constriction of the blood vessels of the hand, and the most marked

The psychology of Feeling.

Past experimental investigations.

Application to aviation.

tremor under conditions of being startled by sudden noises, etc.¹

I have no intention to enter here on the application of the methods of experimental psychology in the field of æsthetics. In regard to applied experi-

ments on interest and attraction of atten- **Psychology of Adver-**
tion, I should like to mention some in- **tisement.**
vestigations on the value of advertisements

according to their position on the page and in the volume. A number of pages were prepared, each bearing an advertisement pasted on to one of the four quarters of the page. It was experimentally found that 33% of the advertisements recalled were those which were pasted on the right upper quarter, 28% on the left upper quarter, 23% on the right lower quarter, 16% on the left lower quarter. That is to say, the right upper quarter gave more than twice the advertising power of the left lower quarter. As the result of another series of experiments it was claimed that the value of advertisements was proved to be less when interpolated in the text of a journal than when they were collected together. Other experiments have been directed to the relation between size and attractiveness of advertisements, and so on.² I only mention them without criticism to exemplify yet another of the practical applications of experimental psychology.

Similarly I will but briefly allude to its application in the field of jurisprudence, as regards the wealth of observation and accuracy of **Application of Psy-**
memory, according to age, sex and other **chology to Juris-**
conditions (in the case of a series of events **prudence.**
which have been witnessed under experi-
mental but natural conditions), as regards the reliance

¹ Cf. *The Lancet*, March 16, 1918, p. 399.

² Quoted by Münsterberg, *op. cit.*

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to be placed on the feeling of certainty and on the oath of the observers of the events, the influence of the particular form in which questions are put to the witnesses, etc.

They are all instances of a change which has of late years been undergone by experimental psychology, resulting in an adequate realisation of the enormous importance of the study of feeling—alike in observation, memory, thought, decision and action.

One of the most important experiments leading to this fuller recognition consisted in the simple study of 'free association reaction times.' A series of words is given to the subject who is instructed to reply to each word by the first word or idea which occurs to him, and by a stop-watch or a chronoscope the interval of time is measured which elapses between the presentation of the word to the subject and his answer. The experiment is an old one, and until recently had been employed solely from the intellectualistic standpoint, the characteristic standpoint of the older academic, 'abstract,' Teutonic, experimental psychology. It had been used, for example, to bring to light individual differences in the nature of the subject's replies according to age, education, occupation, interests, imagination, also to study the influence of fatigue, drugs (*e.g.* alcohol), etc. As soon, however, as investigation was directed to the *association times*, it was observed that in such a series of given words, some words yielded much longer association times than others; and careful analysis showed that a strong emotional bias was attached to the words which produced these long association times. For example, let

Free Asso-
ciation
Reaction
Times.

us suppose that the subject under examination had recently suffered grief through the death of a very dear friend. Then any 'relevant' words,—that is to say, words having reference to the distressing loss,—will be found to yield longer association times than 'innocent' words which have not such a reference. The replies to such 'relevant' words also differed in character from those returned to 'innocent' words.

Into these details it is unnecessary here to enter. My chief object is to indicate the *practical* value of this association test. It has been usefully employed, in the first place, to detect crime. **Their Practical Application.** The suspected person is given a series of words, some 'innocent,' others 'relevant,' having reference to such details of the crime as could only be significant (*i.e.* relevant) for the actual criminal. His associations and association-times are studied in the manner indicated.

The same test has been applied to those cases of mental disorder which are characterized by the repression of experiences toned with severe and troublesome emotion. Sometimes these experiences have been forgotten by the subject, sometimes they are more or less voluntarily concealed by him from his physician.

Thus in an emotionally unstable soldier-patient (from whom I could learn little in conversation), whom I examined by this method, the word 'knife' yielded an unusually long reaction-time. At first he was unable to give me any explanation. But close enquiry showed that when training and firing his first shot at a target, he was frightened at the recoil of his rifle. Always a nervous fellow, he joined up with the Royal

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Engineers (no doubt to avoid the handling of fire-arms); but in an emergency in the trenches, he was one day ordered to stand to, with a loaded rifle, and his former fears returned. They gradually spread to the bayonet and hence to any weapon, such as a knife, which might lead to the injury of himself and others. Finally he confessed that every morning shaving was now attended with the greatest anxiety, lest he might hurt himself accidentally. Thus, the study of free association reaction times put me on the track of certain concealed fears and anxieties which required alleviation, before the patient could be cured.

Of late years our conception of the psychology of forgetting has undergone a very radical change. We

The experimental psychologists used to look on
Psychology of For- learning as a process merely of forming
getting. associations, we used to look on recalling
as a process merely of employing such
associations, and on forgetting as the result of a decay
in the strength of such associations. The factor of
feeling was expressly eliminated from our experiments
on memory. The material learnt in the laboratory
consisted commonly of meaningless numbers or of
senseless syllables, so that all interest or other
reference to past experience might be eliminated as far
as possible. But we now begin to realise that what is
learnt may *never* be forgotten. That is to say, that
given favourable conditions its recall is always possible,
In the cases of nervous breakdown, which have
resulted in this war, it is astonishing how early
emotional experiences may become revived (per-
haps in some distorted form) and become respon-
sible for protracting the emotional condition of the
patient.

APPLICATIONS OF PSYCHOLOGY 31

Moreover, even in such 'abstract' intellectualistic conditions of experiment on memory as those just mentioned, it became clear that the revival of an experience in consciousness does not depend merely on the strength or number of its associations with other previous experiences. ^{Perseveration and Repression.} A past experience also tends to recur *spontaneously*, owing to its inherent tendency to do so especially immediately after learning. It tends to 'persevere,' as the psychologists say. Such 'perseveration' is a common experience outside the laboratory, when we have seen some dreadful sight, heard some joyful news, fallen in love or suffered some similar strong emotion. Apart from logical or other association, such emotional experiences will obtrude themselves throughout the day; and if they are unpleasant we endeavour voluntarily to 'repress' them. But the forgetting of the unpleasant is not merely an affair of conscious intention. It is Nature's own method of getting rid of distressful experiences, to which the subject cannot adapt himself.

Thus forgetting is not merely due to the loss of association strength; it is not merely due to voluntary repression; it is also due to a quite unconscious process of dislocation or ^{Dissociation.} 'dissociation.' A condition, or a 'disposition' as we may say, is induced, by which the voluntary recall becomes difficult or impossible. The unpleasant 'complex,' as we may call a system of ideas associated with a strong, unpleasant emotional tone, becomes more or less completely split off, or dissociated, from the rest of consciousness, much as harmful pus becomes innocuous by becoming enclosed in an abscess cavity. This unfavourable disposition

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for recall may be compared with the converse favourable disposition for recall, which enables us all at once to revive an experience that we have been vainly endeavouring to remember. Suddenly, often to our great surprise, after we have given up the effort to recall, back comes the memory ; a favourable 'constellation' of associations, as it has been termed, has arisen. Such a conception of constellation of associations is something quite distinct from the conception of the number and strength of relevant associations. These must have been constant throughout ; but the condition for their coming into play must have been unfavourable, owing to the presence of certain unknown inhibiting factors. So, too, forgetting depends not merely on the dying strength of previously established associations, but also on an active inhibiting process of dissociation, whereby past unpleasant experiences become dislocated or dissociated from the main stream of consciousness.

Sometimes, in pathological conditions, the process of dissociation involves much more than the distressful memory itself. Not merely the particular memory is lost, but much (or even nearly all) of the previous experience of the patient has disappeared. He may be reduced to a state of complete ignorance of his past, or to a state of temporary stupor, or he may rush about, violently uncontrollable. I have seen many such cases at the front during the present war. The recovery of the patient is generally sudden, and he then recollects nothing of what had caused the shock or had happened to him after the shock. But the memory of these events is nevertheless there. The experiences have not really disappeared. They

**Dissocia-
tion of
Person-
ality.**

have merely become dislocated or dissociated. A man who has thus lain for some days stuporose, may be subsequently quite ignorant of what has occurred to him during these days. If hypnotised, however, he may be readily induced to give an exact account of how he was fed, how he journeyed from one hospital to another, what was said to him, what dream-like experiences he had, etc., etc. Yet upon waking,—unless special precautions be taken,—the dissociation may again at once return. In such cases we are dealing with a dissociation of *personality*, not merely with the repression or dissociation of a single memory. In the stuporose or excited state, the patient is one person; when he suddenly recovers his former personality, he is again a different person; hypnotic suggestion will again reduce him to the personality of the stupor or excitement. The constellation of associations involved in the one personality is unfavourable for the revival of memories belonging to the other personality: the two are incompatible.

Let me give an example of this in the case of a young signaller-patient whom I had under my care quite recently. His story was that a German shell dropped into the signaller's pit, killing and wounding several and knocking him over. The sight of the wounded stimulated him to pull himself together for five minutes while he helped to tend them. He then lost consciousness, and when he came to himself he found himself at the other end of the position, where he recalls asking to be allowed to continue his duty, as only two of his fellow-signallers were left after the explosion of the shell. He said he was much worried over this and subsequent lapses of memory, but under suggestion these were all restored to him and

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by further suggestion they became no longer forgotten and incompatible. He was induced to recall being assisted by Sergeant X. and an unknown gunner, one under each arm, to a neighbouring gun pit where he was placed on the floor and was given a hot drink. He recalled men bustling about with tools, making changes in the gun pit. He recalled Lieutenant Y. coming up to him, and his inability to reply. This officer asked the sergeant how he was. Then the men became quieter in their work, and he passed into a dazed state in which he mused over the loss of his two signaller comrades (one his nearest friend) and the terrible mutilation they had sustained. In telling me this, he became extremely emotional, sweating freely and clutching the chair in which he sat. From this theme his thoughts had passed to his home, where he sat with his papers from the office and his mother was regarding him in deep distress. Then (he knew not why) he was roused and pulled himself together, whereupon he asked not to be sent away from duty. On my asking him later, he recalled all that I had wrung from him through suggestion (there were other forgotten scenes recalled and difficulties cleared up); he was delighted with the relief that this revival brought to his mind. His worries disappeared, and he became bright and looked quite another lad.

The alternation of such conditions is strikingly exemplified in Professor Janet's well-known case of 'Irène.' Irène had undergone a severe shock owing to the death of her mother to whom she was devoted, whom she had nursed while endeavouring to earn her living, and who had died from pulmonary hæmorrhage in circumstances peculiarly distressing for Irène.

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Shortly after, Irène began to develop a dissociated personality. Suddenly, perhaps in the middle of needlework or conversation, she would cease to sew or talk, and would enact all the scenes relating to her mother's death. During this enactment, she was totally oblivious of her environment and would not respond to anything that was said or done to her. This personality would disappear as quickly as it had appeared, and Irène would at once resume her sewing or her conversation, quite unaware that any break had occurred, and without any memory of the scenes she had enacted in the interval. After a few days, the personality connected with her mother's death would again step on to the stage, only to pass away as before, leaving no memory of its appearance behind it. Moreover, on interrogating her, it was found that, save in these apparently abnormal periods, she had become callous and indifferent to the subject of her mother's illness and death, and indeed had entirely forgotten the peculiarly distressing incidents connected with it. In other words, the complex of ideas relating to her shock had become wholly dissociated from her apparently normal personality, and only returned in a trance-like second personality.

But in all these cases of disordered personality, the break is not absolute. Thus, when owing to shock, a man is reduced to a condition of infancy,—professing his ignorance of words, his inability to eat,—his behaviour is not that of an absolutely inexperienced person learning to act. It resembles rather an actor learning a new part, or the left hand learning what the right hand has already learnt to perform (*e.g.* writing). That is to say, he learns far more rapidly than a child.

Psychological experiments on such disorders of

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personality show that a great deal of past experience is really present and utilisable and that the acquisition of knowledge and activities thereby becomes surprisingly easy and rapid. Many cases are now on record where a new personality is built up in this way, differing sometimes in tastes and temperament from the one formerly present. Then, more or less suddenly, —often after a period of shock, stupor, or a 'hysterical' fit,—the old personality appears on the stage, which is completely ignorant of all that has happened since its disappearance. But, again, such dissociation is not complete. It is not due to a sudden and complete transverse block of one stream of consciousness, and its temporary replacement by a second stream. The first stream has been running throughout as an undercurrent, ready to appear in dreams or in hypnosis, or whenever the second stream is, so to speak, off its guard and allows the depressed (repressed) undercurrent to come to the surface. Hence on recovery of the normal personality, all that has occurred during the appearance of the second personality may be obtained in the hypnotised state of the normal personality, although in the waking state the normal personality is 'not at home' to it. Similarly in the case of Irène, when she was enacting the drama of her mother's illness and the tragic circumstances of her mother's death, she was 'not at home' to her environment. She received no conversation through the ear, and took no notice of what she saw. Yet, under favourable conditions, with a pencil in the hand, such subjects have written answers to questions that were put to them, bearing on their ordinary life. In other words, the normal personality persists as an undercurrent which can be tapped under suitable ex-

perimental conditions, in this instance by a kind of automatic writing. It is not the reigning personality that receives the conversation and guides the hand that writes the replies. Indeed the limb may prove to be insensitive to pain at the time of writing: its movements and sensations are dissociated from the reigning personality.

The dissociation may thus involve not merely a mental dissociation (say, a loss of memory or even a change of personality), but also a 'somatic' dissociation, in which a part of the body be-
comes nervously dissociated from the rest **Somatic
Dissocia-
tion.**
and is no longer controlled by the reigning personality. In this way may arise 'functional' paralyses, contractures or spasmodic movements, loss of sensation, or exaggerated sensation,—that is to say, a want of control over the movements or sensations of a part of the body. Yet when the subject is, so to speak, 'off his guard' or 'not himself,' these sensations or movements return to the normal. During sleep such a paralysed limb may move, or a mute person will shout out. A deaf person will blink when an unexpected noise is suddenly produced, showing that the stimulus does gain access, though not to the reigning personal consciousness. A limb which gives no response to pin-pricks will never suffer harm from accidental burns or other injury; a person whose eyes, when tested, are blind to objects other than those to which he turns his gaze, will nevertheless avoid stumbling over objects placed in his path, and will be able to box or to carry out other activities, showing that peripheral vision is there, although he is not conscious of receiving (is 'not at home' to) impressions from this source.

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Enough has been said regarding psychological experiment on the normal and disordered mind to indicate the proper line of treatment in such Treatment. functional nervous (somatic) or mental disturbances. These disturbances are primarily of mental (emotional) origin, due to the disintegration caused by a conflict of incompatible mental experiences or perhaps by sudden shock. Consequently the treatment must be directed to restoring the normal integration by careful and painstaking talks, by the study of associations, by the policy of confession and re-education. When other methods fail, hypnosis often proves the easiest means of obtaining dissociated memories.

Thus a patient of mine was afflicted with the condition known as claustrophobia,—an unreasoning fear of being unable to escape from a small room. The fear had come to him since he was invalided from France for neurasthenia, and I was unable to find out its cause, until, under mild hypnosis, with the greatest persuasion, I elicited from him the long-forgotten memories of being thrown, when seven years old, into a coal cellar by his elder sister after a quarrel, and being pushed into a dark pantry by his mother after being thrashed for loitering on his way from school. His sister, he remembered, shot the bolt in the coal cellar; ultimately someone else let him out. His mother locked the door on him in the pantry which, having no window, was dark: he kicked and struggled there for at least five minutes. Before waking him, I suggested that he would clearly recall these memories henceforth, which he did. And on coming clearly to understand the origin of his dread of small enclosed spaces, the claustrophobia at once

began to disappear. This same soldier on admission had complained of the fear of a man coming from behind him and gripping his throat. On pressing him for further details he described a little dark man in a sailor cap, standing at the corner of a square. The only man he could recall, resembling him, was a certain dentist whom he had recently visited, but he could not recall any incident in his past life connected with the sailor or with the gripping of his throat. He was especially distressed by these fears and visions when he lay down to sleep, and they were accompanied by pains in the left arm and over the heart and by a sinking feeling in the abdomen as if he were falling. (In civil life he had been an ornamental plasterer, but for fear of falling he could not go to any height on a scaffold.) As persuasion in the waking state failed to recall the source of his fears, although it elicited all the emotional expression of the fears (he would clutch his left arm and breast, complain of a tingling sensation in them, experience pain over the heart, but yet could not give these experiences any cause), I proceeded to use more powerful suggestion by getting him into a comfortably drowsy state, whereupon he at once associated the throat-gripping with the fear of a dentist who had recently given him an anæsthetic, which produced a feeling of gripping at his throat and a struggle for breath. The sailor-portion of his hallucination was only cleared up after very great persuasive effort, whereupon he recalled an episode when he was quite a small boy and had been naughty, and his mother had frightened him by telling him that a sailor, standing at the corner of the square on to which his house looked, would come for him, whereupon he crept in terror under the sofa. The arm-pain

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was also accounted for with the greatest difficulty. All at once he obtained a terrifying glimpse of a shell coming, he himself being in a billet, then rushing for safety behind a door jamb and next being forcibly pulled by the left arm down into a cellar. The revival of these past memories, and their explanation to him as the source of his fears, pains and visions, produced an extraordinarily rapid improvement in his condition. He immediately professed that his mind was much lighter. He began to sleep far better. That evening, as he expressed it, he felt "quite elated," "as if a weight were off my mind."

In many cases of spasmodic movement or paralysis, I have been able to cure them at once with the revival of the forgotten, dissociated memories which produced the disorder.

Such somatic disorders disappear, as might be expected, with the return of the complete personality: mental healing in such functional cases is accompanied by bodily healing.

Merely to attend to the bodily symptoms, *e.g.* to apply an electric current to the part affected, or to suggest, in hypnosis or in the waking state, that he can gain proper control over it can lead to no genuine cure so long as there persist anxiety, fear, etc., determined by more or less completely repressed or dissociated memories which cannot be faced. True, the patient may regain his powers of speech or movement, but the underlying mental disturbance remains behind, ready to show itself at any moment in some fresh disorder. To proceed in this way is to imitate a surgeon who might attempt to get rid of an abscess by opening it where it pointed, neglecting to follow

Local
Treat-
ment.

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up the pus to the original source from which it had tracked.

There are, of course, various cases of functional somatic disorder where 'local operation,' as I may term it, *is* successful. These are cases where the paralysis, spasmodic movement or contracture persists as a habit after the main mental trouble (perhaps never severe) has passed away, or when it has arisen not wholly unconsciously after shock, but owing to a state of temporary extreme suggestibility during which the patient has more or less consciously responded to suggestions arising from local pain or from some unpleasant situation. These cases are often of slow origin, of long duration and complicated by the existence of wounds. It is here that local suggestion, discomfort, isolation and the like, compelling the patient to pull himself together and to resume control over himself, are justifiable and most successful.

Repression is often imperfect so that the incompletely dissociated experience finds its expression in various disguised forms. These have been especially studied in the case of ^{Imperfect} repression. dreams, where distortion, condensation, symbolism and other psychological processes working on the emotional experiences of the day-time have been identified and distinguished. Complete dissociation generally occurs suddenly through shock; it is characteristic of a 'hysterical' condition. The disorders of partial repression, to the consideration of which we are now passing, arise gradually from the strain of continued anxiety: they are characteristic of a 'neurasthenic' condition. The former arises from a sudden breakdown, the latter from a

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gradual wearing-down. The neurasthenic state arises from incessant strain, perpetual worry over responsibilities, perpetual conflict between inclination and duty, perpetual endeavour to banish discordant experiences from the mind. Hence, with headache, insomnia, irritability, loss of power of concentration and of self-confidence, arise false ideas, based on, and distorted from, more or less imperfect repression,—ideas of persecution, hallucinations, and the like. Thus instead of continuing to reproach himself, he comes to believe that others are talking disparagingly about him. Or he sees imaginary persons before or behind him or he performs more or less meaningless actions which are really a distortion of the imperfectly repressed complex.

A normal person, when subject to strain and near the point of neurasthenia or nervous exhaustion, can reason about his worries and can pull himself together. But beyond a certain limit, even in the strongest of us, self-control is no longer possible. It is absolutely useless to try to cure the majority of such patients by the policy of telling them to try and forget all about their worries, to occupy themselves with other matters, such as farm work, carpentering and the like. Their condition has arisen because they could *not* adapt themselves to their environment owing to their emotional stress. That stress is too great for normal solution. In the long run, perhaps, time may relieve it ; but the only rational method of treatment is to unearth the repressed experience, to disentangle and to reveal to the subject the mental processes responsible for the distortion, and to get him to face squarely what he has been vainly endeavour-

**Treatment
of imper-
fect re-
pression.**

ing to shun. A man might as well be asked to forget his religion, his patriotism or his politics. These, like the troubles of the neurasthenic, are due to complexes,—systems of ideas firmly connected with emotional experiences. Such complexes colour all his decisions, even those which he believes are arrived at on logical, intellectual grounds. They can only be changed through a conversion of the subject, not by convincing him against his will, but by using every device to get him willingly and actively to accept and to adopt a new and proper attitude to his past experiences. Hence we carefully unravel these more or less repressed experiences of the past, we get the patient to understand their relation to his present troubles, we persuade by the force of reason, we suggest (in the waking or hypnotic state) by the force of new and healthier complexes, until he can face without undue emotion the experiences which have troubled him, clearly comprehending the chain of mental processes responsible for his condition.

Such is the modern method of treating hysterical and neurasthenic disorders. Its success is the surest proof of the trustworthiness of its basis. Its independence of the old psychology is absolute: it is intimately dependent on the more modern psychology with which indeed its very existence is bound up. The results can only be to revolutionise psychological theory and to stimulate further psychological experiment.

The relation of psychology to cases of nervous breakdown.

I have included this subject here for several reasons.

In the first place, every new treatment when first

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applied constitutes an experiment, and we are thus justified in regarding this treatment as being based on psychological experiment.

Secondly, we are brought to a totally new standpoint of the position of functional nervous disorders.

They are essentially of mental origin and demand treatment, not by those who have merely specialised in the effects of specific injuries of the brain, cord or nerves and in movement and sensation, and have come to pay no attention to disorders of will and feeling; nor by asylum doctors whose life is largely spent among cases of advanced and more or less hopeless insanity. A new class of medical man, educated in the psychological theories and practice which I have described, is being trained. One centre of instruction has already sprung into existence during the war and others must be instituted.

A new class of war-hospital is also being established to deal with these cases of functional nervous disorder.

Nothing is so fatal as to group them with asylum patients: one of their chief worries, which has to be alleviated, is the fear of going insane. Almost equally harmful is their admission to the wards of a general military hospital, where they are generally laughed at by the other patients, receive no expert treatment, and find the atmosphere most distasteful.

Thirdly, it has to be emphasized that the treatment of cases of nervous breakdown, by specially trained physicians, in specially allocated hospitals, is not of merely fleeting concern. Neurasthenia and similar psycho-neuroses have not originated merely in the past four years. Nor in

The special training of physicians.

The institution of Special Hospitals.

Their permanence.

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pre-war times has their occurrence been confined to members of the wealthy classes or of the liberal professions.

In Sweden, neurasthenia was found to be rather commoner in the working than in the upper classes.

In a German industrial sanatorium about seventy per cent. of the admissions were nervous cases, the breakdown in by far the majority of which was caused by overstrain.

The frequency and distribution of cases of nervous breakdown.

In various rural districts of the United Kingdom, neurasthenia is frequent enough, and it is especially common in the mining districts of England and Wales; thus a surprisingly large number of cases of shell-shock in this war have arisen among soldiers who were miners in peacetime. Hitherto in this country during peacetime, such patients have had no treatment beyond a bottle of medicine at the out-patient department of a neighbouring general hospital. They have not been admitted to a general hospital unless they have shown some functional paralysis, nor to an asylum until their condition has become one of certifiable insanity.

Lastly, we have come to revise our notions of the position of 'functional nervous' disorders. As Bernard Hart has pointed out, they are to

be regarded as *mental* disorders, inasmuch as we know nothing of the organic changes in the brain which accompany them, any more than we know the organic changes which accompany the mental condition

The definition of 'nervous' and 'mental' disorders.

we call sleep. On the other hand, we have come to regard the insanities, which hitherto have been called mental disorders, as in reality *nervous* disorders; that is to say, they are dependent on far more easily dis-

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cernible, more serious and more permanent changes in the cells of the brain.

How far untreated cases of functional disorder, how far other temporary mental disorders arising from toxins, fatigue, etc., pass over the border into a condition of certifiable insanity is a matter of dispute, but that they do at least sometimes so pass over is an undoubted fact. How far early cases of insanity can be prevented by early treatment from reaching a graver incurable stage is also uncertain. But we are beginning to recognise that in *all* disorders, *e.g.* of the heart, kidneys, etc., the main hope of recovery lies in early treatment when the patient is complaining merely of subjective symptoms, before the signs of recognisable organic changes develop.

In this respect insanity may be compared to phthisis, and functional nervous disorders to recurring attacks of bronchitis. Just as phthisis depends on the exposure of a sufficiently suitable soil to sufficiently prolonged infection, just as it may be cured by sufficiently early treatment and by removal to a sufficiently favourable environment, so we may regard with hope the opportunities of an early and adequate treatment of insanity. So too, just as prolonged bronchitis is fraught with danger in the case of a patient who inherits or develops a soil favourable for tubercular infection, so cases of protracted functional nervous disorders must to some extent finally swell the ranks of the insane.

The difficulties of early treatment are enhanced not merely by the lack of physicians trained in modern psychology, not merely by the lack of hospitals which they can attend as out-patients or be

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treated as temporary in-patients, but also by the popular ignorance and prejudice existing in regard to disorders of the mind. What are needed are courses of public lectures on the subject, pointing out, in language which the people can understand, the psychology of disorders of the mind, the origin of the fears, false shame and prejudice concerning them, the importance and hopefulness of early treatment, and the narrow line which separates mental good-health, mental disturbance, and mental disease.

The need
for popu-
lar in-
struction.

Thus psychology in its modern form, as the study (by observation and experiment) of the normal and abnormal mind, is bound to play an increasing part alike in industry, jurisprudence, education, æsthetics, and medicine. The urgent need now is for institutes of applied psychology in each of our largest cities, which may serve as centres for attacking these practical problems with the help of experts trained both in psychology and in the particular branch in which its help is needed, and with the active, enlightened sympathy of the general public.

Conclu-
sion.

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